

Chemical Process Hazard Analysis Moderate Hazard Review Checklist

(See attached instructions)

Introduction

Every laboratory performing chemical processes should have a current hazard analysis. The Process Hazard Analysis (PHA) is mandatory for chemical processing laboratories to assess the hazards associated with new or modified chemical processes or operations. The Moderate Hazard Review Checklist is used in evaluating the safety of new, modified, or relocated experiments or tests which present a moderate potential hazard to employees, equipment and facilities, or the environment. Laboratory Managers are responsible for completing the analysis. Participation by a representative of the Safety and Environmental Branch (S&EB), Code 205.2, is recommended.

Instructions at the end of this template provide information on the hazard review process, and aid the Laboratory Manager in determining which level of Process Hazard Review is appropriate: Low, Moderate, or High. The Moderate Hazard Review Checklist is used for those processes or experiments that present a moderate potential hazard, but do not require a full High Hazard Review (HHR).

This is a multi-page checklist that requires laboratory managers and workers to work together to ensure that all potential problem areas are analyzed, documentation is generated where necessary, and personnel are made aware of the hazards and safety review findings that affect their work. This checklist, when complete, becomes part of a safety documentation package that will be controlled in accordance with GPG 1410.2. This package should be available in a prominent location in the laboratory while the work is in progress.

Laboratory Identification

| | | |
|--------------------------------|------|------|
| Laboratory Name/Description | | |
| Laboratory Location | | |
| Laboratory Manager | Code | Ext. |
| Product/Experiment Description | | |

Moderate Hazard Review Checklist

BRIEF DESCRIPTION OF PROCESS:

To check a checkbox, double-click on the box, and select Checked or Not Checked.

A. Have the following been defined by appropriate documentation? Check if done.

- ☐ 1. Process description
- ☐ 2. Process flow diagram/equipment
- ☐ 3. Material Safety Data Sheets (MSDS)
- ☐ 4. Laboratory Safety Procedures, including (as applicable)
 - ☐ a. Emergency Procedures
 - Shut-down
 - Spills

- ☐ b. Specialized Operating Procedures:
 - Normal Start-Up
 - Normal Operation
 - Normal Shutdown
- ☐ c. Lockout Procedure
- ☐ d. Operating Hazards (including chemical, mechanical, etc.)
- ☐ e. Line Break Procedure
- ☐ f. Personal Protective Equipment
- ☐ g. Procedure for Modifications
- ☐ h. Waste Disposal Procedures

ATTACH all of the above documentation to this checklist

B. Evaluate and describe the following potential hazards, and the necessary precautions taken for each. Attach supplemental sheets as necessary. Check when completed.

- ☐ 1. Toxicity of solids, liquids, and gases associated with the process (Consult MSDS)
- ☐ 2. Reactivity and explosion hazards of solids, liquids, and gases associated with the experiment or process (Consult MSDS)
- ☐ 3. Corrosiveness of solids, liquids, and gases associated with the process (Consult MSDS)
- ☐ 4. Ignition sources such as sparking motors, switches, alarms, exposed heaters, etc.
- ☐ 5. Fuel sources such as feedstock, products, solvents, gaseous reaction products, insulation, etc., in the area that could be ignited (Consult MSDS)
- ☐ 6. Sound level exposure
- ☐ 7. Nuclear radiation
- ☐ 8. Radiations such as ultraviolet, infrared, microwaves, lasers, X-rays, etc.
- ☐ 9. Pressure system failure (projectiles, shrapnel, sprays from leaks, etc.)
- ☐ 10. Electrical (e.g., bonding, grounding, sources identified/labeled)
- ☐ 11. Pressure and temperature transients
- ☐ 12. Ergonomics (spacing, access to equipment, physical requirements of job)
- ☐ 13. Other (describe)

C. Consider and evaluate the effect of your work in the following environmental areas. Attach supplemental sheets as necessary. Check when completed.

- ☐ 1. Identification and resolution of potential air, water and soil pollution
- ☐ 2. Identification and development of written disposal methods for all wastes

- ☐ 3. Air emissions and air emission rates calculated and reported to the Safety and Environmental Branch

D. Confirm that the following have been provided in the design and construction of the equipment/apparatus. Check left column if OK.

1. Piping and Instrumentation

- ☐ a. Pressure relief valves and/or rupture disks where necessary (vessels, positive displacement pumps, blocked-in lines, blocked-in heat exchangers, compressors, etc.) with no valves or restrictions of any kind in the lines between the equipment and the protective devices
- (1) Properly sized ☐ Yes ☐ N/A
- (2) Proper set pressure ☐ Yes ☐ N/A
- ☐ b. Proper relief and blow-down system with no valves or restrictions of any kind in the lines between the protective devices and the point of discharge
- ☐ c. Emergency overflow lines ☐ Yes ☐ N/A
- ☐ d. Emergency shutdown system ☐ Yes ☐ N/A
- ☐ d. Emergency shutdown system
- ☐ e. Suitable alarms, shutdowns, interlocks, purges, etc., to bring unit to a safe automatic shutdown in the event of an emergency such as:
- (1) Loss of instrument air ☐ Yes ☐ N/A
- (2) Loss of steam ☐ Yes ☐ N/A
- (3) Loss of cooling water ☐ Yes ☐ N/A
- (4) Loss of electric power ☐ Yes ☐ N/A
- (5) Loss of fuel ☐ Yes ☐ N/A
- (6) Severe leakage by rupture of piping or equipment, by leakage from stuffing boxes or mechanical seals, or due to corrosion ☐ Yes ☐ N/A
- (7) Fire in the area of the unit ☐ Yes ☐ N/A
- (8) Other (Explain if Yes) ☐ Yes ☐ No
- ☐ f. Alarms for all other critical variables (high/low temperature, high/low pressure, high/low flow, high/low level, etc.)
- ☐ g. Automatic shutdown of certain pieces of equipment if certain critical variables are exceeded (high/low temperature, high/low pressure, high/low flow, high/low level, etc.)
- ☐ h. Fail-safe positioning of control valves and solenoid valves in the event of instrument air loss or electrical failure
- ☐ i. Pressure, temperature, flow, and level measurement devices installed at all critical points
- ☐ j. Suitable devices to prevent the flow or backup of materials into undesirable areas
- ☐ k. Suitable interconnect methods to utility systems such as water, gas, electricity, etc. (e.g., use of Back Flow Preventer Valve in a potable water system)
- ☐ l. Backup pumps, compressors, etc., where required for safety
- ☐ m. Automatic detection devices, as applicable, for:
- (1) Toxic materials ☐ Yes ☐ N/A
- (2) Combustible mixtures ☐ Yes ☐ N/A
- (3) Radiation ☐ Yes ☐ N/A
- (4) Oxygen detection ☐ Yes ☐ N/A
- (5) Fire ☐ Yes ☐ N/A

If Yes for any of above, describe:

2. Pressure vessels, pumps, compressors, heat exchangers, etc.
- ☐ a. Proper materials of construction with consideration for corrosion, fatigue, stress cracking, embrittlement, strength, toughness, etc. Special care should be taken when using glass.
 - ☐ b. Proper design and material for seals and gaskets
 - ☐ c. Proper design pressures and temperatures
 - ☐ d. Guards on all rotating, reciprocating, and conveying equipment
- ☐ 3. Vessel identification, tagging, and record keeping in accordance with Center's procedures? If not, explain.

E. Chemical Description. Check left column if OK.

OK

- ☐ 1. What **Chemicals** are used in your process?
- ☐ 2. Are any of the Chemicals: (check all that apply)

| | |
|--|--|
| <input type="checkbox"/> Carcinogen | <input type="checkbox"/> Developmental Toxin |
| <input type="checkbox"/> Flammable | <input type="checkbox"/> Light Sensitive |
| <input type="checkbox"/> Mutagen | <input type="checkbox"/> Peroxidizable |
| <input type="checkbox"/> Pyrophoric | <input type="checkbox"/> Radioisotope |
| <input type="checkbox"/> Reactive With Air | <input type="checkbox"/> Reproductive Toxin |
| <input type="checkbox"/> Shock Sensitive | <input type="checkbox"/> Temperature Sensitive |
| <input type="checkbox"/> Toxic/Poison | |
- ☐ 3. If your Chemicals display any of the above listed characteristics, is the ductwork certified as leakproof? ☐ Yes ☐ N/A
- ☐ 4. If your Chemicals display any of the above listed characteristics, will access to the roof be prohibited while you are running your experiment or equipment? ☐ Yes ☐ N/A
- ☐ 5. How will these Chemicals be stored?
- ☐ 6. If refrigeration is required, is the refrigerator or freezer alarmed, approved, and properly marked for chemical storage? ☐ Yes ☐ N/A

F. Transportation and Storage. Check left column if OK.

OK

- ☐ 1. How will you transport chemicals in the building or across the site?
- ☐ 2. Will chemicals be shipped off site? ☐ Yes ☐ No
 If Yes, do you have the necessary information for the 20-4 Shipping Request? ☐ Yes ☐ N/A

G. Area: Evaluate the following safety items and describe the reason or location for each.

OK Check left column if OK.

- ☐ 1. Are there limits on personnel in attendance while operating?
- ☐ 2. Are there special area requirements, e.g., High Noise?
- ☐ 3. Are barricades required?
- ☐ 4. Are special signs or alarms needed?
- ☐ 5. Are exits from laboratory or area adequate (standard and emergency)?
- ☐ 6. Where are the nearest fire and/or evacuation alarms?

- ☐ 7. Where are the nearest fire extinguishers?
- ☐ 8. Have extinguishers been inspected within a year? When?
- ☐ 9. Where is the nearest Safety Shower and/or Eye Wash?
- ☐ 10. Has the eyewash been inspected weekly?
- ☐ 11. What is the location of the nearest telephone?
- ☐ 12. Does the nearest telephone have a 911 emergency sticker?
- ☐ 13. Will there be any unattended operation of this process? If so, what special procedures will be implemented?
- ☐ 14. Will this process be operated by a lone worker?
If yes, explain.
- ☐ 15. Will this process be operated after normal working hours? If yes, what special procedures will be implemented?
- ☐ 16. Are the Emergency Contact names and phone numbers posted on the door?

H. Training: describe or attach list of any special training required, and identify for whom.

I. Are there any corrections that must be made before startup?

At this time, print this document and obtain the appropriate signatures. The following are required:

CERTIFICATION AND APPROVAL:

Certification by the Laboratory Manager that all required corrections have been completed, the laboratory process is safe (subject to completion of required training), and procedures are properly implemented and understood.

Laboratory Manager Signature/Code *Date* _____

Certification by laboratory personnel that they have read and understood this Hazard Review and associated laboratory procedures: (use additional sheets if necessary)

Laboratory User Signature/Code *Date* _____

Laboratory User Signature/Code *Date* _____

Laboratory User Signature/Code *Date* _____

Laboratory User Signature/Code

Date _____

Laboratory User Signature/Code

Date _____

Branch Head Approval:

Signature/Code

Date _____

Concurrence by Code 205.2, if they participated in the review:

205 Concurrence Signature

Date _____

Following all approvals, a copy of this document and its attachments, including a copy of the Hazard Analysis Selection Matrix, shall be posted in the laboratory area and placed under configuration control per GPG 1410.2. A dated copy shall be sent to Code 205.2.

General Instructions for Laboratory Process Hazard Analysis

Introduction

The identification and control of hazards in the laboratory is the responsibility of the owning organization. The Laboratory Process Hazard Analysis is designed to aid management in meeting this responsibility.

The Process Hazard Analysis (PHA) is mandatory for laboratories and other areas that use chemicals for other than normal housekeeping purposes. These analyses are used to assess the hazards associated with new or modified processes or operations in a laboratory environment. There are three levels of reviews for three anticipated levels of hazards: Low, Moderate, and High.

The Hazard Analysis Selection Matrix provides the Laboratory Manager a quick way to assess the level of process hazard analysis required. The matrix has three vertical columns that correspond to the three levels of review. Horizontal lines describe various potential hazards. By checking those that apply in the appropriate columns, the necessary review level becomes easier to define.

Approach

The first step in determining the level of review required is to fill out the **HAZARD ANALYSIS SELECTION MATRIX** on the last page of these instructions. There are four major sections to the matrix: Material Hazards, Processing Hazards, Equipment Hazards, and Environmental Hazards. Various criteria within these categories determine the level of hazard analysis required.

These guidelines are the MINIMUM suggested methods, and are not meant to be a substitute for good judgment. Combinations of lower level hazards may indicate a need for a higher level of review. Conversely, if in your judgment you can use a lower level of hazard review than that indicated by these guidelines, you may do so with the approval of the Laboratory Manager and Division Chief.

Levels of Process Hazard Analysis

1. **Low Hazard Review (LHR):** Low Hazard Review (LHR) is conducted when the hazard is deemed “low”. Low hazard is defined as having little potential to create injury or property damage, and no potential for environmental release. A LHR requires completion of a brief description of the process, the potential hazards, and what steps will be taken to mitigate those hazards. A set of operating procedures, the personal protective equipment required, special training required, and the signature of those involved with the review must be included. The Laboratory Manager and users conduct this level of review. The review is performed using GSFC Form 23-56.
2. **Moderate Hazard Review (MHR):** Moderate Hazard Review (MHR) is conducted when the hazards involved are deemed “moderate”. Moderate hazard is defined as having the potential to cause injury, equipment damage, or environmental release. Laboratory Managers and users conduct an MHR. The involvement of a safety representative can be requested and is encouraged. A MHR requires the completion of a comprehensive checklist, and must be accompanied by a complete set of standard operating procedures. Among the information evaluated are process technology, potential hazards and mitigation, environmental issues, and adherence to specific engineering/design standards. The review is performed using GSFC Form 23-57.
3. **High Hazard Review (HHR):** High Hazard Review (HHR) is conducted for experiments, equipment installations, or processes which are deemed “high hazard”. High Hazard is defined as having the potential to cause serious injury, severe equipment or facility damage, or negative environmental impact.

A HHR Committee shall be established for each Laboratory that meets the criteria for High Hazard Review. The HHR Committee will consist of a chairperson, a representative from the Safety and Environmental Branch,

researcher, technician, member of the Chemical Safety Committee (CSC), and any other resources deemed necessary. A comprehensive review by the HHR Committee of all potential hazards involved in processes and equipment is required. A member of the CSC or an S&EB representative can help determine what type of HHR method will be used based on the nature of the hazard(s) presented. The HHR requires that a number of documents be assembled and made available to the review committee. Piping and instrument diagrams, chemical reaction characteristics, relevant incident reports, process chemistry, and operation procedures are all required.

The review is performed using GSFC Form 23-58 and must be documented completely. The HHR Committee must approve significant changes.

Required Participation for Process Hazard Analysis

| Position | LHR | MHR | HHR |
|------------------------------|------------|------------|------------|
| Laboratory Manager and users | X | X | X |
| Branch Head | X | X | X |
| Safety Representative | | | X |
| Additional Technical Sources | | | X |

Documentation Requirements

- The Hazard Analysis Selection matrix, a copy of the most recent Hazard Review, and operating procedures/attachments must be available in a prominent location in the laboratory while the work is going on.
- A dated copy of all safety documentation packages, including hazard reviews, Hazard Analysis Selection Matrices, and operating procedures, shall be sent to the Safety and Environmental Branch, Code 205.2.

Hazard Analysis Selection Matrix

For new, modified or relocated processes, equipment or experiments, or scale-up of previous work, characterize your process according to the criteria below. Then use the most detailed analysis method called for by any single criterion.

| | No Review Required | LHR* | MHR* | HHR* |
|--|------------------------|-------------------------------------|--------------------------|----------------------|
| 1. Material Hazard – Acute Toxicity | | | | |
| HMIS Health Rating: circle the Hazardous Material Identification System rating, found in the Material Safety Data Sheet (MSDS) | 0 | 1-2 | 3 | 4 |
| Cylinder DOT Label: if a cylinder, circle Yes if the DOT label on the cylinder indicates Poison Gas, Corrosive Gas, or Flammable Gas | | | Yes | |
| 2. Material Hazard – Chronic Toxicity. Circle Yes if the MSDS indicates the material exhibits Chronic Toxicity. | | | Yes | |
| 3. Material Hazard – Flammability. Choose applicable line and circle the MHIS rating from the MSDS | | | | |
| <1 Liter & MHIS Flammability Rating | 0-1 | 2-4 | | |
| >1 Liter & MHIS Flammability Rating | 0 | 1-2 | 3-4 | |
| > Liter and under Pressure or above Flash Point & MHIS Flammability Rating | 0 | | 1 | 2-4 |
| 4. Material Hazard – Reactivity. Circle one. | | | | |
| HMIS Reactivity Rating from MSDS | 0-1 | 2 | 3-4 | |
| 5. Processing Hazard – Radiation. Circle all that apply. | | | | |
| Laser | | Class I-III A | Class IIIB–IV | |
| X-Ray Source | | <20kv | >20kv | |
| Radioisotopes in use | None | | Yes | |
| UV, Infra-red, Microwave, Radio wave | | <TLV | >TLV | |
| 6. Processing Hazard – Pressure. Circle any one that applies. | | | | |
| Non-glass | = 0 psig | <0 psig or >0 psig & <90 psig | >90 psig | |
| Glassware | | | <0 or >0 psig | |
| 7. Processing Hazard – Chemical Reaction Energy | | | | |
| Will adiabatic reaction lead to temperature change? Circle the one that applies. (Check MSDS). | <60° F | | >60° F | |
| Will this cause solvent to boil? Circle yes, if applicable. | | | Yes | |
| 8. Processing Hazard – New Technology | | | | |
| New chemistry or technology. Circle correct answer, if applicable. | None | | Outside of Experience | Unknown Reactions |
| 9. Equipment Hazard – Electrical. Circle one if applicable. | Protected <120V | Exposed or >120V | | |
| 10. Equipment Hazard – Mechanical. Circle yes or no. | | | | |
| Exposed pinch points, belts, chains, rotating parts, knives, suspended loads, stored energy, etc. | No | Yes | | |
| 11. Equipment Hazard – Thermal. Circle one if applicable. | | | | |
| Unprotected heated or chilled surfaces | > -20° F & < 140° F | < -20° F & >140° F | | |
| 12. Environmental Hazards. | | | | |
| Noise. Circle one. Call x6-6669 if you need assistance. | <80 dBA | >80 dBA | | |
| Hood/Ventilation Testing. Circle one if applicable. | | Exemption | Permit | |

Contact the Safety and Environmental Branch for assistance if ratings are not available, or if any other assistance is needed in completing the matrix for the forms.

***ACRONYMS**

DBA decibels, A-scale
DOT Department of Transportation
HHR High Hazard Review
HMIS Hazardous Material Identification System

LHR Low Hazard Review
MHR Moderate Hazard Review
OT Odor Threshold
TLV Threshold Limit Value

Branch Head

Date

Laboratory Manager

Date